THE FOSSIL COLLECTOR

BULLETIN Nº6 DECEMBER 1981

PROVISIONAL SECRETARY

F.C.Holmes, 15 Kenbry Rcad, Heathmont. Vic. 3135.

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AUSTRALIAN CAPITAL TERRITORY:

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NEW ZEALAND:

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Mrs. D. Vincent, 6 Caroline St., Launceston. 7250.

VICTORIA:

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NORTHERN TERRITORY:

D. Aslin, P.O.Box 1032, Alice Springs, 5750.

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EDITORIAL

We hope members will forgive us for not having this Bulletin to print in December as originally planned. Because of problems associated with the holiday season our feature article could not be completed in time, resulting in a mad rush to prepare a replacement - not something that happens over night.

On a more cheerful note we are happy to report that at the close of this our second full year, membership stands at 145 including second and subsequent members of a family. While this is only a small increase on last year, our financial situation, on the other hand has greatly improved, consequently there is no need for any increase in the annual subscription rate of $4.00.

Enclosed in this Bulletin is a membership renewal form which should be completed and returned to the Provisional Secretary by the end of February,1982 to ensure that you receive Bulletin No.7.

On the bottom of the form is a space for comments. Please fill this in as we need to know if you are satisfied with what we have achieved so far and how you think we can improve and encourage more people to join the Association.

One thing that has surprised us during the last two years is how few requests for information have been received from members. While it takes time to prepare answers to your questions, the article on Xystridura in this edition and on Brazilian Fossil Fish in Bulletin No.3, should illustrate the professional expertise that can be provided by our readers.

Finally may we take this opportunity of wishing you all a very happy and prosperous New Year.

Frank Holmes

FOSSIL DISPLAY AT TOOWOOMBA

Ian Sobbe, our Queensland representative reports that members Lindsay Berry, Cyril Wheeler, Robin Philp, Graham Cook and himself,together with Rupe Wissemann and Joyce Thomas put on a display of fossils at the Toowoomba Lapidary Club Show last November By all accounts the 7.2 metre long display was well received by the public and in addition the local T.V. Station DDQ10 had a really good video segment in its news transmission. According to Ian, most visitors to the Show took at least 15 minutes to look at the fossil display which gives some idea of the public interest in palaeontology.

FINANCES

Income and Expenditure for the period 1st January to 15th December 1981 (excluding costs associated with Bulletin No.6) was as follows :-

Income		Expenditure (excludes this Bulletin)	
B/fwd. from 1980	$ 13.29	Postage	$ 108.60
Subscriptions	506.99*	Printing	122.09
Donations	13.72	Car Stickers	90.00
Advertising	35.20	Stationery	35.78
Bank Interest	4.00	Sundries	1.24
Sale of Bulletins	49.60	Refund o/p sub.	1.60
Sale of Car Stickers	76.80		
Miscellaneous	0.20		
	$ 699.80		$ 359.31
	359.31		
Balance in hand	340.49		

* Includes five advance 1982 Subscriptions

Based on the previous Bulletins, the anticipated cost of printing, postage and envelopes for this Bulletin (No.6) is $112.00 which will leave the Association with a credit balance of just over $200.00, and enable us to keep the annual subscription at $4.00.

OVERSEAS COLLECTORS WISHING TO EXCHANGE FOSSILS

A group of Italian Geologists are preparing to establish a new palaeontological museum in Italy and are anxious to obtain first class Australian fossils for display.

In exchange they can offer museum quality specimens from many European formations including starfish, ammonites, plants, crabs, lobsters, fish and some vertebrate material.

Specimens should be well identified with details of naturally, collecting locality, formation and age as well as scientific name.

Members wishing to contact the group should write to:-

Dr. Flavio Bacchia
v.Sara Davis 20,
34135, TRIESTE, ITALIA.

IN THE NEWS

RARE FIND IN WESTERN AUSTRALIA

A 15 million-year-old fossilised cuttle bone has been found on Barrow Island by two scientists from the Museum of W.A.

The bone, about 12cm long, was recovered in a weathered limestone cliff on the western side of the island.

It is only the second to be found in Australia and one of a handful discovered in the world.

The discovery was made by Dr.Ken McNamara and George Kendrick, working with Harry Butler under a Wapet-Barrow Island research grant.

Dr.McNamara, who is the museum's curator of palaeontology, said the group also found more than 50 species of molluses, including some new species and some which were still living on Barrow Island, within a 100 metres of the fossil beds.

Dr.McNamara said the fossil deposits were known about 30 years ago but this was the first time they had been examined systematically.

They were of major scientific importance because they were the only tropical marine fauna of the Miocene era known in Australia.

Because the deposits were unexpectedly rich and diverse they allowed scientists to look at the "fine tuning" of marine animal associations and the changes they had undergone in the last 15 million years.

West Australian - 5-11-'81.

ROADWORKS TO HELP PALAEONTOLOGISTS?

Increased road-making in the North of Western Australia is resulting in excavation work in areas not previously investigated by scientists.

High on the list of expected finds, according to Dr. McNamara, Curator of Palaeontology at the W.A.Museum, are the remains of dinosaurs and the more recent extinct member of the wombat family zygomaturus.

Dinosaurs are known to have existed in the Kimberley region but to date the only trace has been of footprints found near Broome. Scattered remains of zygomaturus, which died out about 20,000 years ago have been found in the Murchison, along the Carnarvon-Mullewa Road near Ballinyoo bridge. As further roadworks are planned in the area the Main Road Department and Shire workers in the Murchison have been asked to keep a lookout for bones.

Zygomaturus grew to about the size of an ox and is a relative of the larger diprotodons found in the Eastern Sates.

Extract from Western Mail 30-10-'81.

IN THE NEWS Cont:

Other cuttings from Western Australian newspapers received during the year cover the discovery of 40 million year old Eocene casuarina fruit from the Darling Range; perfect preservation of a 50 million year old banksia cone from the Kennedy Ranges; the return to W.A., after 15 years of intensive study in Britain, of a 350 million year old skull of the lungfish Griphognathus whitei; and further discoveries of tracks belonging to the giant scorpion like amphibious animals called eurypterids that lived 400 million years ago.

OPALISED PLESIOSAURUS AT WHITE CLIFFS

At the old pioneer opal field of White Cliffs, N.S.W., may be seen the most complete opalised skeleton of a plesiosaur yet found. The stubby tail, long neck, and squat, almost square head are very obvious although some of the bones of its paddle like limbs are missing. One of the remaining limbs however, is a vision of green/blue opal while one of the polished ribs is a rich purple.

Dr. Alex.Ritchie of the Australian Museum, Sydney, puts its age at about 100 million years. Adult plesiosaurs grew to 12 metres (40 feet) or more so the 2.5 metre (8½ ft.) length of this skeleton infers that it was quite a baby. The number of shafts dug close to where the find was made suggests that other miners hope to discover one of the parents!

Like so many discoveries, luck played a large part in the find;two inches to the right as the shaft was dug and the whole thing would have been missed. Luck or not, the find draws people from all over the world as the owner's visitors' book shows.

As the person who "baby-sat" the dugout through two recent hot summers I know from experience that many came to White Cliffs in the middle of summer, just to see the remains of our "oldest inhabitant".

Gwen Rowe, White Cliffs.

RHYNIELLA The Earliest Known Insect

The search for insects (Class Hexapoda) in rocks of Devonian and Lower Carboniferous age has continued for many years because so little is known of the early history of these diverse and abundant animals. In 1926 four head capsules of an insect named Rhyniella praecursor were discovered in Lower Devonian chert from Rhynie, Scotland, by examining thin fragments of the semi-translucent amber like chert. Subsequently about 10 additional specimens were found showing the legs and thorax of this insect. Generally it has become

Cont...

RHYNIELLA, The Earliest Known Inseet. Cont.

aecepted that R.praecursor belongs to the living Order Collembola or Springtails, a widespread flightless group of insects. However, several charaeteristics of Collembola were not preserved in the fossils and doubts remained particularly as the apparent similarity of Rhyniella to some speeialised modern Collembola suggests that Rhyniella could be a modern contaminant. Paul Whalley and E.A. Jarzembowski from the Department of Entomology of the British Museum have shown that Rhyniella is not a contaminant following re-examination of samples collected over 50 years ago.

Grinding and repolishing some of the specimens revealed a new speeimen consisting of a thorax with legs and the first discovered eomplete abdomen. Extending from the ventral surfaee of the abdomen is a structure corresponding to the fureula (spring) of reeent Collembola. The presenee of a fureula confirms that Rhyniella was a springtail; the total length of the inseet being approx. 1.5 mm.

Examination of several speeimens showed that they were eompletely fossilised in ehert and did not resemble modern eontaminants. A petrologieal examination in polarised light revealed that the enelosing ehert was homogeneous and certainly represented a single phase of mineral growth. One Rhyniella specimen was associated with plant fragments identieal to other Rhynie plants of undoubtedly Devonian age.

Whalley and Jarzembowski eonelude that Rhyniella praecursor is of Lower Devonian age (approx. 380 million years old) and consequently the oldest known inseet deseribed to date, however, the relationship of Rhyniella with Reeent Collembola Neanuridae is eonsidered doubtful.

from Nature Vol.,291, 28th May, 1981.

XYSTRIDURA SAINT-SMITHI? by David Morley.

The following is a brief outline of the nomenclature, history, morphology and age of the trilobite Xystridura which is found in the Northern Territory and N.W. Queensland, and upon which our Club emblem is based.

The first trilobite now referred to this genus, was found by H.Brown (then Govt.Geologist of Sth.Australia) near Alexandria Station in the Northern Territory in 1894 and described by R. Etheridge Jr. in 1897 as Olenellus browni. Etheridge placed the species in Olenellus rather than the Paradoxidae because he regarded the anterior facial suture (see morphology below) as a crack in the specimen. In 1924 E.C. Saint-Smith placed on record the first Cambrian trilobites found in Queensland some of which were also noted as belonging to the genus Olenellus by W. Dun.

In 1929 F. Chapman described eight new trilobite species belonging to four genera, from outcrops in the beds of the Thornton and Templeton Rivers in N.W. Queensland. The commonest species was listed as Bathyuriscus saint-smithii from the head of the Templeton River 12 miles west of Mt.Isa and named in honour of E.C. Saint-Smith,(an engineer at the Mt. Isa Mine). Another species described was Milesia templetonensis from the same locality and named in honour of another of the collectors, Mr.Campbell Miles. The remaining species listed were Bathyuriscus nitidus,B.olenelloides, Marjumia milesi, M.conspicabilis, M. elegans, Dikelocephalus dunstani.

The genus name Xystridura was first introduced by E.W.Whitehouse in 1936 to replace Milesia Chapman 1929, and Olenellus browni Etheridge, 1897 and was selected as genotype and became Xystridura browni. In 1939 Whitehouse proposed the subfamily Xystridurinae and regarded the eight species described by Chapman (1929) as belonging to the same species. The senior synonym chosen was Xystridura saint-smithi as it was the first species described by Chapman, 1929. Whitehouse redescribed Xystridura saint-smithi and Xystridura browni (= Olenellus brownii Etheridge 1897).

From 1939 onwards Xystridura saint-smithi was therefore the name used for all specimens of Xystridura found in the shales of Beetle Creek and surrounding district. However, in 1975 A.A. Öpik, after careful restudy of the original materials and extensive collections by Commonwealth geologists in the 1950's divided the Xystridurid trilobites in three new sub-genera, i.e:-

Sub-genus XYSTRIDURA (Xystridura), Whitehouse
(type species = Milesia templetonensis Chapman 1929
of genus &
sub-genus = X.templetonensis (Chapman)) Cont....

XYSTRIDURA SAINT-SMITHI? Cont.

Sub-genus XYSTRIDURA (Inosacotes) Opik
(type species = Olenellus browni (Etheridge Jr.)
= Xystridura browni (Etheridge)
Whitehouse, 1936.)
Sub-genus XYSTRIDURA (Polydinotes) Opik
(type species = X. (Polydinotes) verticosa)

Of the 19 species listed by Öpik. five had been described previously- one by Etheridge and four by Chapman, and 14 were new species.

Whitehouse (1936, p.74), expressly introduced Xystridura to replace Milesia as he had found that Latrielle in 1804 had erected another genus using the name Milesia and under the laws of nomenclature the first use of a generic name has priority. If the original name is re-used inadvertently, the subsequent names must be replaced.

The laws of nomenclature clearly state however, that when a name is replaced, the new generic name must be identified with the type species of the replaced generic name. Consequently the type species of Xystridura Whitehouse 1936 must be the type species of Milesia Chapman 1929. As M.templetonensis was the only species assigned by Chapman to Milesia it automatically became the type species and therefore the type species of Xystridura. Whitehouse was wrong in designating another species as genotype, regardless of whether he considered M. templetonensis a valid species or not. He restricted the name Xystridura saintsmithi to a single specimen, the holotype originally designated by Chapman (1929) as Bathyuriscus saint-smithii, which has an incomplete pygydium with evidence of three annulations in its axial lobe, which may or may not be the complete number. The total length of the specimen is close to that of X.dunstani and Öpik (1975) states "...the species name Xystridura templetonensis (Chapman) prevails over its subjective synonyms, including perhaps the commonly used X.saintsmithi....", "...saintsmithi may be a synonym of templetonensis or of dunstani; or it may be an independent species (saintsmithi)...".

The five species found at Beetle Creek are Xystridura templetonensis, X.milesi, X.dunstani, X.saintsmithi and X.hamosa.

The most common is X.templetonensis following the revised nomenclature of Öpik.

Other species found in N.W.Queensland are Xystridura carteri and X.yaringensis, the remaining species listed by Öpik (1975) are, from the Northern Territory, X.browni, X.verticosa, X.triligata, X.filifera, X.lauta, X.davidsoni, X.altera, X.remorata, X.sandoverensis, X.gayladia and X.negrina and X.fracta from N.W. New South Wales.

The only species known from outside Australia are X.hainanensis Sun (1963) from an island off South China and X.glacia Palmer & Gatehouse (1972) from Antarctica. It is also reported from N.W. China at several localities along the Mongolian border.

The above trilobites from Australia are from the two earliest Middle Cambrian stages (Ordian and Templetonian), the outcrop at Beetle Creek is referred to the Beetle Creek Formation (Templetonian) and Xystridura is also present in the contemporary Thorntonia limestone. Xystridura first appeared in the Ordian of the Northern Territory, then became widespread in the Templetonian of the Northern Territory and Queensland. Two distinct biogeographic provinces are known here, one in the Northern Territory and N.S.W., and one in Queensland; and no two species of Xystridura so far described are common to both regions, inferring a possible land barrier between the two areas at that time (Öpik 1975).

The morphology of Xystridura is close to that of Paradoxides and the similarities are: both have a clavate glabellar; the posterior margin of the free cheek is long; they have similar hypostoma; and they both have an almost identicle morphogenisis.

Characteristics of the genus Xystridura (Xystridura) are:-

CEPHALON - large "olenelloid" rostral shield, extending into the free cheek; large clavate glabella, extending into the anterior marginal furrow; glabellar furrows are disconnected; long arcuate palpebral lobes (eyes) opposite the rear of the glabella, and relatively close to the axial furrows; moderately long genal spines; the occipital furrow is continuous and placed well in advance of the posterior marginal furrow; and the facial sutures are functional.
THORAX - fixed number of thirteen segments, which is a taxanomic character of Xystridurinae; the fulera and fulcral lines are close to the axial lobe, and fulcral joints are weak; pleurae are equipped with pleural spides, which prevent entanglement of the pleura; and an oval to elliptical body with the thorax narrowing rearwards.

PYGIDIUM - large, fused and quadrispinose (having two pair of spines) with bacculae and pleural cushions; two full caudalized segments (similar to those of the thorax) are present complete with pleural furrows; anterior margin is arched forward; and the segmental annulations vary from one to five, depending on the species.

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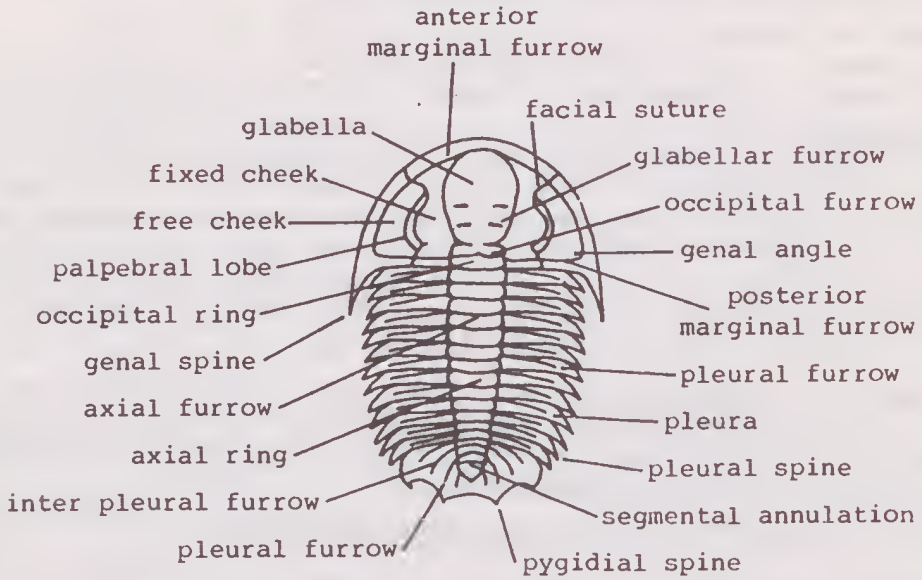
XYSTRIDURA SAINT-SMITHI? Cont.

SOME PROMINENT MORPHOLOGICAL FEATURES OF XYSTRIDURA:



The above drawing (which is of Xystridura templetonensis Chapman) was drawn mainly for use on our car stickers, and finer details were omitted to aid in reproduction during printing. However, after further study of specimens, photographs and literature, the following points should be noted:-

The three glabellar furrows and occipital furrow should be placed farther forward on the glabella; the palpebral lobes should be closer to the glabella, the pygidium is too wide and short.

CLASSIFICATION:

Superfamily.....Paradoxidacea
Family.....Xystriduridae
Subfamily.....Xystridurinae
Genus.....Xystridura
Subgenus.....Xystridura
Species.....templetonensis

(after Öpik 1975).

From the above, it can be seen that the first trilobite drawn for our magazine was incorrect in the following details: it only had twelve thoracic segments; the occipital furrow was incomplete; and a missing characteristic, which is either not preserved in specimens

or not noticed by those unfamiliar with Xystridurids, was the four thorn-like marginal spines, which are pleural extremities developed in the pygidium during the meraspid (late juvenile) and holaspid (adult) stages of growth.

To the best of my knowledge the above information is correct, being obtained from some of the published works listed below. Any professional criticism would be greatly appreciated, as one of the aims of our Association is to encourage responsible and scientific attitudes to the collection and classification of fossils among our members, and the knowledge gained may eventually be used as an aid in describing new fossils - hundreds, perhaps thousands of which are still awaiting discovery and classification.

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NOTE.
The Author wishes to thank Dr. K. McNamara of the West Australian Museum, Perth, for his letter about the genus Xystridura, and Dr. Peter Jell of the National Museum of Victoria, for comments on the draft article.

THE FOSSIL COLLECTOR

THE ANIMAL KINGDOM - CLASSIFICATION OF THE PHYLUM ECHINODERMATA

Introduction

We hope this will be the first of a series of short articles on the classification of both fossil and living animals within the major phyla.

It is not intended to go into any great detail or generally list classifications below the level of Class, rather to show the wide variety of animal groups that can be classified within one Phylum.

As most of you will know every recognisably different living and fossil organism is given two names; a SPECIFIC name, the smallest unit of division in general use and; a GENERIC name, an arbitrary unit consisting of a number of closely related species with similar features. This system of identification is known as the BINOMIAL SYSTEM.
While it is important to fit related genera into a FAMILY, related families into an ORDER, orders into a CLASS and classes into a PHYLUM, the intermediate stages (families and orders) can be confusing to the amateur because of the large number of divisions within these sections, the more complex definitions, and the general lack of a common name to aid recognition. In any case this information is available if required, in the technical literature and such works as The Treatise of Invertebrate Palaeontology.

These articles will be illustrated wherever possible to give a basic idea of the general form of the organisms within a particular Class, and naturally should not be used for specific identification.

Finally it must be realised that the classification of the hundreds of thousands of living and fossil organisms is constantly under review, consequently you will be lucky to pick up two text books that agree in every detail about the various classifications. However, the main groups we will be dealing with are now generally accepted, though one authority may raise or lower a particular group to a different level of classification than that used by another.
We have chosen the phylum ECHINODERMATA as the first of this series as, to the amateur, it covers a fascinating and diverse group of animals such as the crinoids (sea lilies), echinoids, starfish, blastoids, cystoids and carpoids. What is more important is that nearly all these groups are represented in the Australian fossil record and in many cases are currently being worked on by our own Palaeontologists.

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CLASSIFICATION OF THE PHYLUM ECHINODERMATA (Cont.)

Approximately 20,000 species of echinoderms have been described, of which only 5,000 or so are living today.

General Classification and affinities of the phylum ECHINODERMATA

The Greek name of the phylum (echino + dermata, meaning spiny "prickled" skin) was originally used only to describe the sea urchins (marine echinoids) and the terrestrial hedgehog.

The name is now used to describe a group of "spiny skinned" exclusively marine invertebrate animals distributed through almost every conceivable environment around the world from shallow seas to deep oceans.

The two common features shared by virtually all members of the phylum are a pentameral (five-rayed) symmetry and an internal skeleton consisting of crystalline calcareous plates. Within the skeleton (test) of most echinoderms is a water vascular system, an elaborate system of hydraulic tubes and spaces which primarily aids locomotive and respiratory functions. This system is unique to the Phylum.

The echinoderm skeleton, covered by a leathery outer skin, is a product of internal secretion, individual hard parts being able to increase in size during the life of the organism. This ability to grow includes the appendages such as the rays, arms and stems.

In the overall classification of the animal kingdom they are placed above the molluscs and arthropods and next below the hemichordates and chordates, their larvae resembling the larval forms of primitive hemichordates.

Up to the middle of the nineteensixties, the ECHINODERMATA were divided into two subphyla: the ELEUTHEROZOA, free living forms such as the sea stars, sea urchins and sea cucumbers and the PELMATOZOA, forms more or less permanently attached to the bottom, such as the sea lilies, feather stars and the extinct blastoids.

This division of the Phylum has now been discarded in favour of a classification based on a given pattern of body symmetry that appears to be present in the skeletal material of both living and fossil echinoderms and which points to a preferred growth gradient followed by the hydrocoel (water vascular system) either along meridional (longitudinal) lines as in the Class ECHINOZOA (echinoids and holothuroids) or radially divergent lines as in the Classes CRINOZOA and ASTEROZOA (crinoids and starfish etc.)

Cont...

THE FOSSIL COLLECTOR

CLASSIFICATION OF THE PHYLUM ECHINODERMATA (Cont.)

This latter method of classification is the basis used in this article to illustrate the diversity of the Echinoderm fauna, however,as we have previously stated, new evidence is constantly coming to light which can easily alter opinion about the "correct" classification of a particular group.

SPECIFIC CLASSIFICATION - Subphyla and Classes

Subphylum ECHINOZOA : Armless, essentially globoid echinoderms.

Class ECHINOIDEA (A) : Includes sea urchins,heart urchins and sand dollars. About 5,800 species, 5,000 of which are extinct. Range:Ordovician to Recent,(found in Australia).

Class HOLOTHUROIDEA (B) : Sea Cucumbers. Generally free-living echinozoans with cylindrical body, mouth encircled with tentacles at one end and anus at the other. Range: Ordovician? L.Devonian to Recent. (found in Australia but not described).

Class HELICOPLACOIDEA (C) : Free living helicoplacoid echinoderms with spirally pleated, expansible and flexible test. Range: L.Cambrian only. (NOT found in Australia).

Class EDRIOASTEROIDEA (D) : Ancient branch of the attached echinoderms, sacklike or low discoid body. Flexible theca composed of many irregular polygonal or rounded plates with ambulacral system,composed of five ambulacra confined to upper hemisphere of the test. Range: L.Cambrian to L. Carboniferous. (found in Australia). Note: Includes CAMPTOSTROMATOIDS, free living medusaeform echinozoans originally placed in a seperate Class by Durham 1966. Range: L. Cambrian only.

Class OPHIOCISTIOIDEA (E) : Free living, extinct pentaradiate echinozoans. Test with calcareous plates and periproct on aboral surface. Aboral side flat, with central mouth and buccal apparatus consisting of five interradial jaws. Range: L.Ordovician to M.Silurian. (found in Australia).

Class CYCLOCYSTOIDEA (F) : Small discoid echinoderms that display the echinozoan pattern. Calcareous plated theca composed of oral and aboral disks both of which are attached to a framework of thecal plates. Range: M.Ordovician to M.Devonian.(doubtful if represented in Australia).

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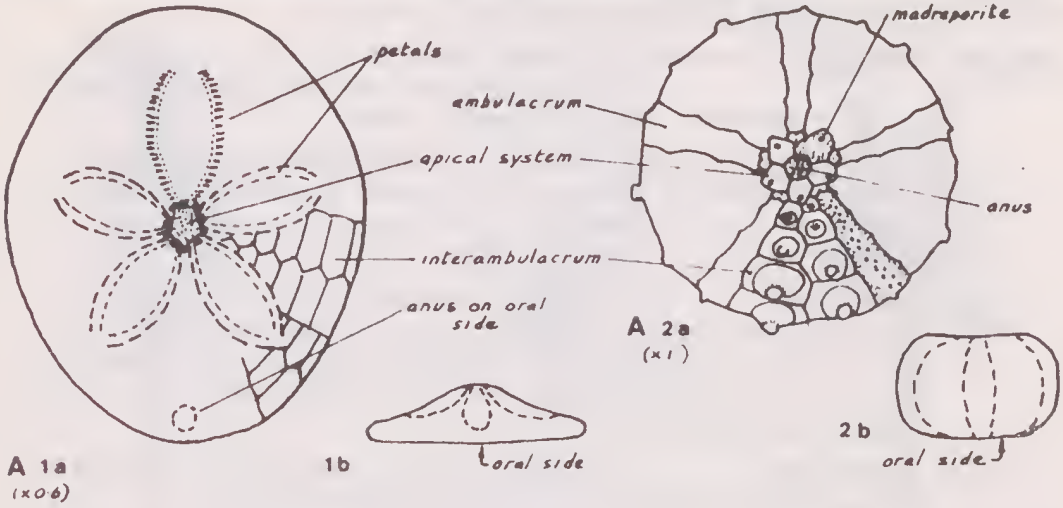
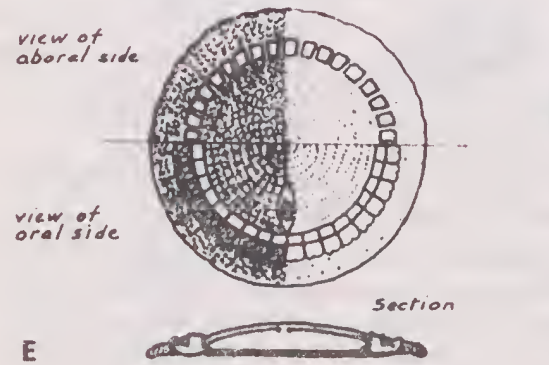

petals
ambulacrum
apical system
interambulacrum
anus on oral side
madreporite
anus
A 1a
(x0·6)
1b
oral side
A 2a
(x1)
2b
oral side


B (x1/3)
C (x1¼)
D (x2)


view of aboral side
view of oral side
Section
E
periproct
second opening
F

Cont...

CLASSIFICATION OF THE PHYLUM ECHINODERMATA (Cont.)

Subphylum HOMALOZOA (Originally Class CARPOIDEA) : Extinct echinoderms with body flattened dorso-ventrally; radial symmetry absent.

Class STYLOPHORA (G) : "Uniradiate" homalozoans with plated theca to which is attached a jointed appendage (aulacophore) bearing the mouth at its base. Range: M.Cambrian to M.Devonian. (found in Australia).

Class HOMOIOSTELEA (H) : Biradiate homalozoans with multiplated theca, with single, biserial anterior arm bearing cover plates and a long posterior tail (heterostele) composed of differentiated plates. Range: U.Cambrian - L.Devonian. (found in Australia)

Class HOMOSTELEA : Triradiate homalozoans with skeleton of plated theca and tail. Range: M.Cambrian only. (not found in Australia)

Subphylum CRINOZOA : Globoid, placoid echinoderms with arms and having meridional symmetry.

Class CRINOIDEA (J) : Includes sea lilies and feather stars. Pentamerous crinozoans commonly with a long segmented stalk (crinoids), secondarily stalkless and free-living (comatulids). Cuplike calyx (theca) composed of a regular pattern of plates and containing the lower part of the body. Over the calyx is a plated membrane (tegmen) bearing the upper part of the body. The arms are skeletal processes that articulate freely with the calyx and are usually branched. Of the four subclasses INADUNATA, CAMERATA, FLEXIBILIA and ARTICULATA, only the latter (range: L.Triassic to Recent) exist today. Overall Range: L.Ordovician to Recent. (found in Aust.)

Class PARACRINOIDEA (K) : Intermediate group between true crinoids and "cystoids". Have plated theca, undifferentiated into calyx and tegmen, thecal plates that form irregular patterns and are variable in number and uniserial arms (free or attached). The presence of thecal pores distinguishes paracrinoids from crinoids. Range: M.Ordovician only. (not found in Australia).

Subphylum BLASTOZOA : Echinoderms with characteristic biserial brachioles, commonly mounted on recumbent ambulacra;pore or foldlike respiratory structure; globular multiplated calyx, stem or holdfast. Classes in this subphylum were formerly included in the Crinozoa

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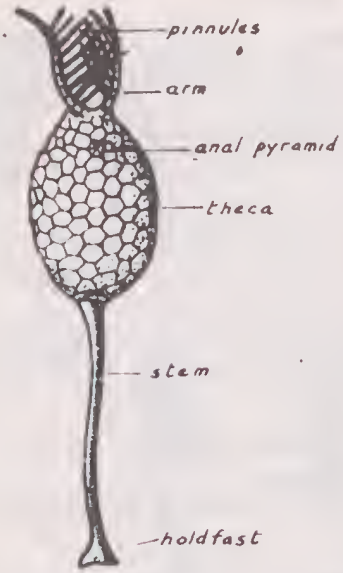

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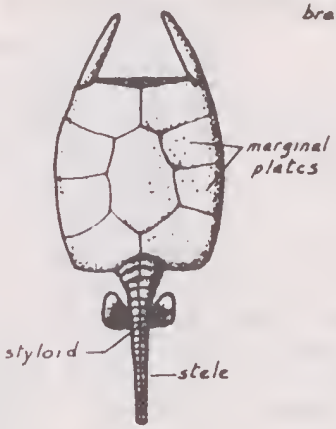

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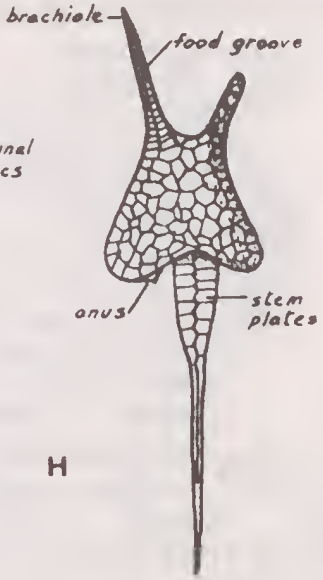

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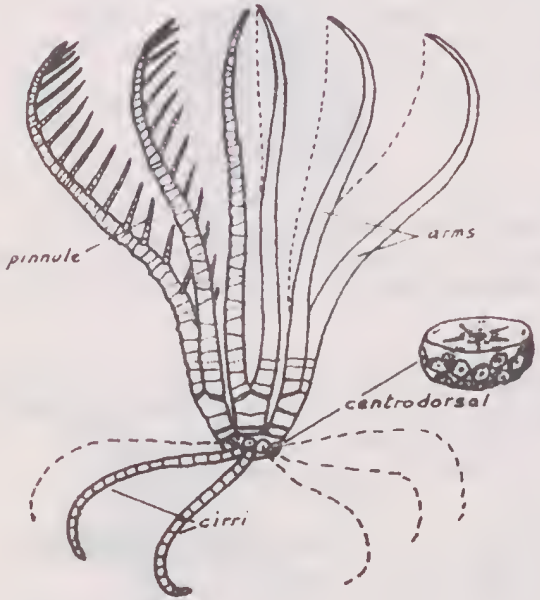

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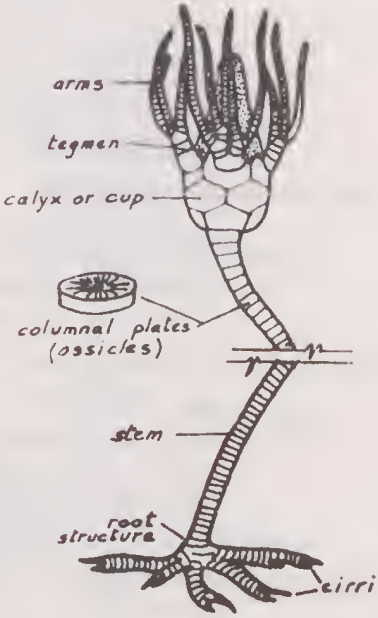

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CLASSIFICATION OF THE PHYLUM ECHINODERMATA (Cont.)

Class BLASTOIDEA (L) : Previously treated as a sub-class of the cystoids. Stemmed blastozoans bearing internal or external hydrospires, biserial brachioles attached to corner of ambulacra and plated calcareous theca. Range: Silurian to Permian. (found in Australia).

Class EOCRINOIDEA (M) : Earliest known Blastozoa. Have a tripartite construction; plated theca; thecal appendages (brachioles) and hollow column or stem. Range: L.Cambrian to Silurian. (Not found in Australia).
Note: Includes LEPIDOCYSTOIDS, free living placoid echinoderms originally placed in a separate Class by Durham 1967.
Range: L. Cambrian only.

Class PARABLASTOIDEA (N) : Blastoid like stemmed blastozoans with strongly developed pentameral symmetry.
Range: L. to M. Ordovician. (Formerly order of blastoids-not found in Australia.)

Class RHOMBIFERA (P) : Formerly an order of the Cystoids. Structures called Pore-Rhombs comprise an arrangement of laterally directed passageways consisting of tubes or grooves in adjoining pairs of thecal plates. The outline of the pore bearing area is rhombic or diamond shaped and each plate of the pair bears one half of the rhomb.
Range: M. Ordovician to U. Devonian.
(Found in Australia).

Undetermined Subphylum:

Class EDRIOBLASTOIDEA: Blastoid like stemmed echinoderms with regular pentameral symmetry. Range: M.Ordovician.
(Formerly assigned to Edrioasteroids - found in Australia).

Undetermined Subphylum:

Class DIPLOPORIDEA (Q) : Formerly an order of the Cystoids. Has pores extending subvertically through the plates. Commonly external openings of the pores are arranged in pairs (diploporcs). Range: M.Ordovician to L.Devonian.
(Not found in Australia).

Subphylum ASTEROZOA : Free-living echinoderms, radially symmetrical with star-shaped body lacking a stem.
(Originally described with only one Class (Stelleroidea) and three subclasses, two of which are now raised to Classes).

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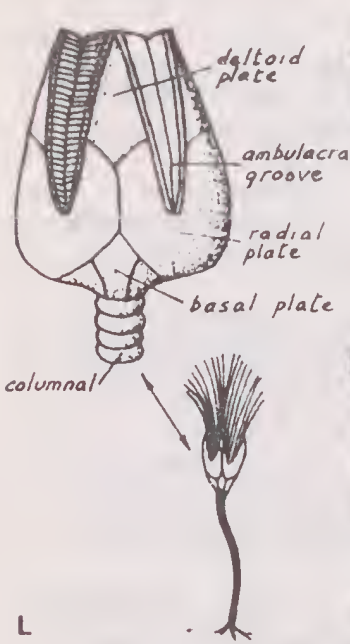

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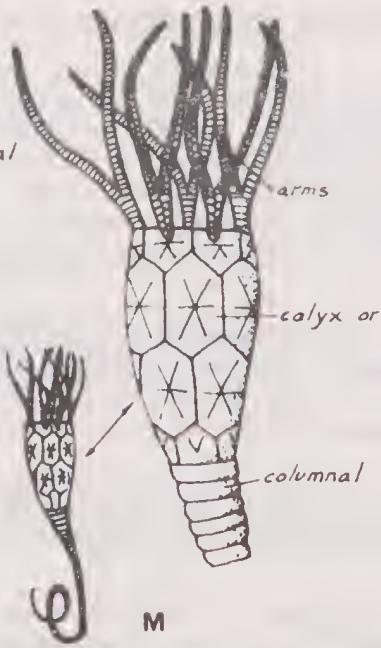

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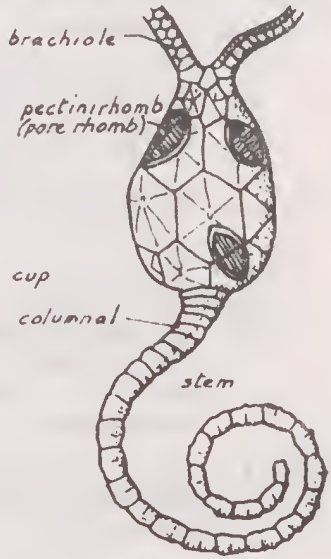

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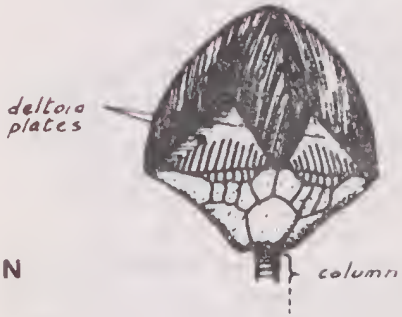

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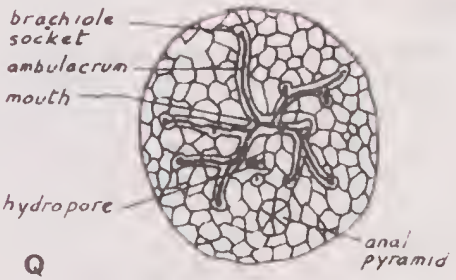

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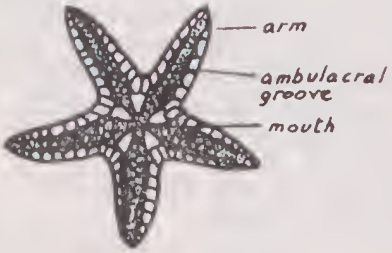

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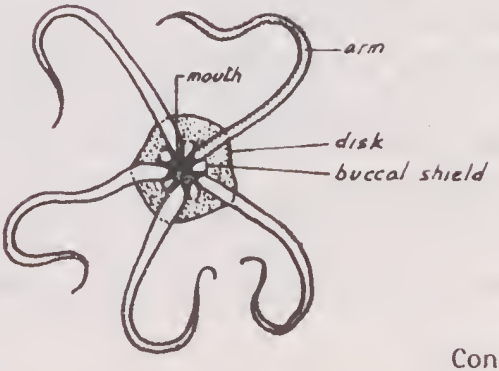

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CLASSIFICATION OF THE PHYLUM ECHINODERMATA (Cont.)

Class ASTEROIDEA (R) : Starfish having generally hollow arms which contain large lobes of body cavity and enclosed organs; radial canals located on outside of skeleton. Range: Ordovician to Recent. (Found in Australia). Note: Includes SOMASTEROIDS - primitive starfish having a double row of semicylindrical ossicles partly or completely surrounding the radial canals.

Class OPHIUROIDEA (S) : Commonly called Brittle-Stars. Have slender whiplike arms built around a core of ossicles; radial canals deeply sunken or completely enclosed in skeleton. Range: Ordovician to Recent. (Found in Australia.)

NOTES 1. R.P.S. Jeffries 1968 assigned STYLOPHORA to primitive chordates. Subphylum CALCICHORDATA, this however is disputed.

2. Sprinkle 1973 assigned EOCRINOIDEA, BLASTOIDEA, RHOMBIFERA and PARABLASTOIDEA to a seperate subphylum BLASTOZOA.

SUMMARY

The description of the subphyla and classes of echinoderms included in this article is by necessity brief and can only give a very general outline of the phylum. At the end of the description of each class, we have given the known geological range and a note as to whether any species belonging to the class have been found in Australia. Out of the 19 classes listed, fossils have been described from 11 and are known but not described from a further class, the Holothuroidea (sea-cucumbers). The remainder, with the possible exception of the Cyclocystoidea are not known from the Australian fossil record at this time. We must stress the phrase "at this time" as, who knows, tomorrow someone may find a specimen from a class not previously described from this continent, particularly as much work is being done on the echinoderm fauna from the Siluro/Devonian of the Melbourne Trough. We can look forward to papers being published on the Edrioasteroids, Starfish and Crinoids in the not too distant future and possibly other groups that little has been written about in the past.

For those interested in Tertiary Echinoids there are many recent papers by G.M. Philip and R.J. Foster amongst others.

Cont...

KEY TO ILLUSTRATIONS.

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A. ECHINOIDEA: 1. Irregular echinoid Clypeaster
a. aboral view, b. side view.
2. Regular echinoid Hemicidaris
a. aboral view, b. side view.
B. HOLOTHUROIDEA: Sea cucumber Cucumaria (Recent).
C. HELICOPLACOIDEA: Helicoplacus curtisi. Restored in semi-expanded form (L.Cambrian).
D. EDRIOASTEROIDEA: Isorophus cincinnatiensis. Dorsal view (Ord.).
E. OPHIOCISTIOIDEA: Volchovia mobilus. Reconstruction (L.Ord.).
F. CYCLOCYSTOIDEA: Cyclocystoides halli. Reconstruction (M.Ord.).

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G. STYLOPHORA: Rotocarpos garratti. Carapace (Silurian).
H. HOMOIOSTELEA: Dendrocystites (Ordovician).
J. CRINOIDEA: 1. Comatulid (free swimming) Ptilometra mulleri (Rec.).
2. Crinoid (attached). Generalised diagram.

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K. PARACRINOIDEA: Comarocystites punctatus (M.Ordovician).
L. BLASTOIDEA: Pentremites. General view of calyx (Carboniferous).
M. EOCRINOIDEA: Macrocystella (Cambrian).
N. PARABLASTOIDEA: Blastoidocrinus (M.Ordovician).
P. RHOMBIFERA: Pleurocystites (M.Ordovician).
Q. DIPLOPORIDEA: Glyptosphaerites (M.Ordovician).
R. ASTEROIDEA: Starfish; generalised diagram, oral view.
S. OPHIUROIDEA: Brittle Star; generalised diagram, oral view.

TECHNICAL TERMS

ABORAL - upper side of the test opposite the mouth
AMBULACRUM - (pl.ambulacra) shallow groove on arms or brachioles and on surface of theca, leading to mouth.
AMBULACRAL - plate of the paired rows of plates which form the food grooves radiating from the mouth.
AULACOPHORE -a jointed appendage bearing the mouth at its base (carpoids).
BRACHIOLE - free appendage of cystoids or eocrinoids which bears a food groove and is attached at border of an ambulacrum.
BUCCAL APPARATUS - five large plates (mouth/dental) surrounding mouth (orphiocistioids).

Cont...

CLASSIFICATION OF THE PHYLUM ECHINODERMATA (Cont.)

CALYX - the structure consisting of dorsal cup and tegmen, which contains the bulk of the body (crinoids).

COMATULIDA - Order of articulate crinoids (includes the host of free-swimming crinoids which dominate crinoid life in modern seas). The stem is abandoned after an early larval stage. Comatulids do not contain a calyx but a centrodorsal bearing many cirri (jointed appendages) which is formed by solid fusion of the lower cup plates with upper stem segments.

DIPLOPORE - paired arrangement of thecal pores.

HYDROCOEL - water vascular system.

HYDROSPIRES - infolded thin-walled respiratory structures beneath border of an ambulacrum (blastoids).

OSSICLES - any calcareous plates, segments or rod like parts of the skeleton (asteroids).

PORE RHOMB - group of parallel horizontal tubes or slits occupying parts of two adjoining plates (rhombifera).

PENTAMERAL - five rayed.

PERIPROCT - a plated membrane surrounding the anus.

TEGMEN - a membrane with or without plates, which covers the oral side of the body (crinoids).

TEST - the entire echinoid skeleton.

THECA - body of primitive attached echinoderms.

TENTACLES - greatly extended branches of water vascular system surrounding the mouth (holothuroids).

TUBE FOOT - hollow extension of water vascular system used primarily for locomation.

RADIAL CANAL - water vessel which supplies tube feet (asteroids).

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